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J. W. L. GLAISHER, M.A., F.R.S., President, in the Chair.

W. H. S. Monck, M.A., 13, Belvedere Place, Dublin,

was balloted for and duly elected a Fellow of the Society.

On some suggested Improvements in the Practical Working of M. Loewy's New Method of Determining the Elements of Astronomical Refraction. By David Gill, LL.D., F.R.S., Her Majesty's Astronomer at the Cape of Good Hope.

The progressive requirements of exact astronomy have, for a long time, demanded in vain a direct, simple, and practical method for determining the elements of refraction.

The method proposed (*Comptes Rendus*, tome cii. p. 74) appears at last to indicate the means by which such a determination can be made with all desirable accuracy, and the author, M. Loewy, deserves the congratulations, as well as the thanks, of astronomers for the powerful, elegant, and simple method which he has suggested.

M. Loewy proposes to place a prism having two silvered reflecting surfaces inclined to each other at 45° in front of the object-glass of a telescope. The prism is mounted symmetrically with respect to the optical axis of the telescope; the line of the intersecting reflecting planes being next the object-glass, and capable of rotation in a plane at right-angles to the axis of the telescope.

The arrangement is shown in the accompanying fig. 1 :—

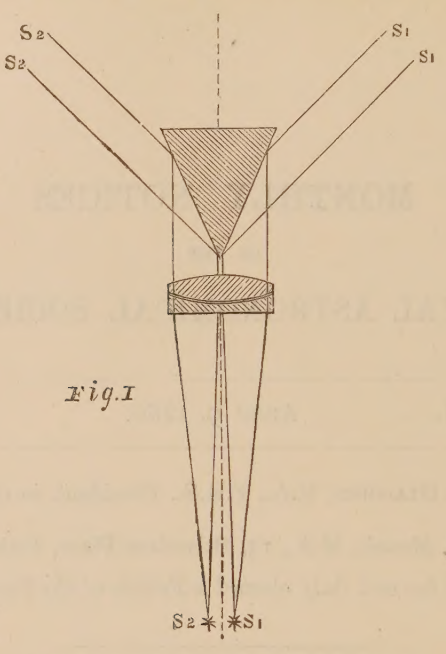

Fig.1

The figure represents the path of the rays from stars S_1 and S_2, where the angle between the stars is slightly greater than twice the angle of intersection of the reflecting planes of the prism.

The apparatus is mounted as an ordinary equatorial telescope. In this way any two stars in the heavens which are 90° on the great circle apart ± (the diameter of the field of view) can be seen simultaneously in the field when the axis of the telescope is directed to the middle point between the stars, and the prism is turned so that the line of intersection of its reflecting planes is at right-angles to the great circle joining the stars. The distance between the images of the stars in the field of view will vary in consequence of the changes of refraction due to the change of altitude produced by the diurnal motion. The apparent angle between the stars themselves will be a maximum when both stars have the same altitude, and a minimum when one is on the horizon and the other at the zenith.*

If a spider-line micrometer is attached to the eye-end of the telescope so that its direction of measurement is at right-angles

* The angle between the images in the field of view will follow the same law when the angle between the stars is greater than twice the angle of the prism, but will be reversed when the angle between the stars is less than twice the angle of the prism.

to the line of intersection of the reflecting planes of the prism, then this micrometer will measure the true change of the distance between the stars (that is, the variation of the effect of refraction) entirely independent of any small changes in the position of the prism with respect to the axis of the telescope, such as may be supposed to be produced by flexure of the support of the prism.

It will be seen from this brief summary of M. Loewy's proposal that the investigation of the elements of refraction may thus be made to depend entirely on easy differential measures, which can be rapidly made with practical freedom from all systematic errors except those which may be due to atmospheric chromatic dispersion.

Having considered the practical details which are necessary for the most perfect realisation of these ideas, I am led to propose a few modifications of M. Loewy's apparatus, which promise to increase the ease of working as well as the general accuracy and utility of the method.

1. Instead of a fixed telescope-tube with rotation of the prism in front of the object-glass, let the prism be attached rigidly to the cell or mounting of the object-glass, the latter attach rigidly to the tube, set the webs of the spider-line micrometer permanently parallel to the line of intersection of the reflecting surfaces of the prism, and give rotation to the whole tube round its own axis, by placing it in a cradle attached to the Declination axis, after the manner of the tube of a modern heliometer. A position-circle attached to the tube, and read by verniers attached to the cradle, should also be provided. By these means a sufficiently rigid relation between the prism and spider-line micrometer would be preserved, and the necessity for computing the setting of the direction of measurement for the spider-line micrometer would be entirely avoided.

To find the two stars it would only be necessary to direct the tube, by the R.A. and Declination Circles, to the hour-angle and Declination of the middle point between the stars, and to set the position-circle to the angle which the great circle joining the two stars makes with a circle of Declination passing through the middle point between the stars. Both stars would then be seen in the field of view, and by small movements of the position-circle and of the slow-motion handles in R.A. and Declination, these images may be brought between the fixed position-angle wires (which mark the direction of measurement), and the measures can then be made by the movable wires with the greatest facility. The resulting measures are independent of any possible small motion of the prism relative to the axis of the telescope, and of any errors in the adjustment of the equatorial stand. The altitude of the stars can be deduced, with all necessary accuracy, by noting the time of each observation.

Convenient and simple as this observation may appear, it is subject to the objection that angles exceeding ten minutes of arc

cannot be measured by the spider-line micrometer with sufficient accuracy, when it is necessary that both objects be simultaneously bisected. The choice of objects for observation is thus limited to pairs of stars whose distance is equal to twice the angle of the prism $\pm 10'$ of arc. This objection could be overcome by the use of two eyepieces, or still better by the device of Alvan Clark, which, "by a convenient arrangement of prisms enables both webs, though separated one degree in a large telescope, to be seen in the same eyepiece." Unfortunately the latter arrangement is not described in detail by its author, and is said to be, as yet, somewhat troublesome to arrange previous to measurement, though, when arranged, it gives very good results.

2. An investigation of the elements of refraction on the preceding plan involves the construction of a complete special apparatus, but it becomes comparatively easy to adapt a modern heliometer to the purpose. It is only necessary to mount the prism in front of the object-glass, with the line of intersection of its reflecting planes at right-angles to the line of section of the segments of the object-glass and to the axis of the heliometer.

Observations can then be made by bringing the two images into coincidence in the centre of the field by symmetrical movements of the segments of the object-glass, as in the ordinary process of measurement with a heliometer. Unfortunately, by this method, angles smaller than twice the angle of the prism cannot be satisfactorily measured, but the large range of angle embraced by the heliometer makes this of little consequence. The chief drawback to the method is that when the objects do not differ much from 90° apart (that is, when the optical centres of the segments are nearly in coincidence) only one quarter of the whole area of the object-glass is available for seeing each star, and in order to give symmetry to the images at all distances it would probably be necessary to place diaphragms, shaped thus (fig. 2), on both segments of the object-glass.

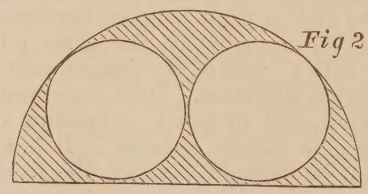

Fig 2

Thus with a heliometer object-glass of 4 inches aperture, the available aperture for seeing each star would correspond with that of an object-glass but little over $1\frac{1}{2}$ inch aperture. This, however, would permit accurate observation of stars to the 6th magnitude, and an ample selection of pairs of such stars would be available within the range of 88° and 90° in distance.

Royal Observatory, Cape of Good Hope:
1886, February 26.

Note on the Observations for Coincidence of the Collimators through the Cube of the Transit Circle at the Royal Observatory, Greenwich. By H. H. Turner, B.A., B.Sc.

For some time after the erection of this instrument, observations for coincidence of the Collimators could only be made after first raising the instrument, so that the view of one Collimator by the other was uninterrupted. In 1866 December, however, the central cube of the Transit Circle was perforated so that when the instrument was placed vertical a view of the South Collimator by the North could be obtained through eight holes of sector form, symmetrical about the common axis of the Collimators. The radial bars separating these sectors were not cut away in the hope of avoiding any serious interference with the rigidity of the cube, although this prevented the use of the central portions of the object-glasses of the Collimators in the observations. It was noticed soon afterwards that there was a small discrepancy between the readings for coincidence of the North Collimator on the South obtained when the Transit Circle was raised as before, and those obtained by this new method of viewing; but Sir George Airy, in commenting on it in his Report to the Board of Visitors in 1868, expressed some scepticism as to the reality of the discrepancy, and was more inclined to attribute the apparent discordance to "an erroneous habit in the application of the eye to the eye-glass, combined with a very small error of focal adjustment." The results of a number of observations in 1869 and 1870 were collected, however, and the mean difference of readings of the micrometer of the North Collimator was found to be $0^{r}\cdot020$ and $0^{r}\cdot024$ respectively, corresponding to $0''\cdot48$ and $0''\cdot58$. Experiments were made in 1872 November by two observers to test whether the position of the eye made any sensible difference in the reading for coincidence of the Collimators, but no such effect was discernible.

Accordingly from 1874, January 1, the discrepancy was accepted as real, and the reading obtained through the central cube was regarded as erroneous to that extent, owing to some cause not sufficiently explained; a correction of $0^{r}\cdot019$ (equivalent to a difference of $0^{r}\cdot023$ in the reading for coincidence of Collimators) being applied to the concluded reading for line of collimation of the Transit Circle micrometer.

The examination of the results of weekly observations in subsequent years confirmed this value of the correction as sensibly constant.

It still remained, however, to satisfactorily explain the discrepancy, and to determine whether the observations made with the Transit Circle raised had been correctly regarded as the standard. It seems very unlikely that the raising of the instrument produces an actual disturbance of either Collimator, for

the weight of the instrument is still borne by the pillars carrying the pivots. It was suggested

(*a*) That the change of position of such a large mass of metal might cause changes of temperature in the lower portions of the air of the room, and consequently changes in the refraction.

(*b*) That the discordance might be purely optical, either of the nature of diffraction, or due to a difference between the line of collimation of the edges of the Collimator object-glasses and that of the central portions.

As regards diffraction, the symmetry of the arrangement of the holes in the cube about the common axis of the Collimators would appear to obviate the possibility of an unsymmetrical discordance, such as that under consideration.

To discriminate between the other suggestions, in 1885 December a wooden model of the central cube of the Transit Circle was made which could, when the instrument was raised, be placed in the position usually occupied by the central cube, and the South Collimator could be viewed through the corresponding holes in the model cube. If the reading thus obtained for coincidence agreed with that when the instrument was raised and nothing interposed, it would seem that the discordance was due to differences of temperature, while an agreement with the reading taken through the ordinary cube would indicate that the phenomenon must be referred to the cutting off of the central portions of the object-glasses.

The following observations have accordingly been taken with this wooden cube:—

Date.	Observer.	Readings of North Collimator Micrometer (Transit Circle raised.)		
		Through the ordinary central cube.	Through wooden model cube.	Uninterrupted Vision.
		r.	r.	
1885, Dec. 28	H. T.	·508	·529	·465
		·526	·528	·467
1886, Jan. 6	L.	·490	·531	·481
		·493	·508	·487
Feb. 1	T.	·534	·550	·491
8	A. D.	·572	·557	·542
23	L.	·412	·400	·359
Mar. 8	A. D.	·419	·420	·398
15	H.	·553	·548	·503
22	A. D.	·501	·470	·452
Mean ...	... ...	·501	·504	·465

(The initials H. T., A. D., T., L., H. are those of Mr. Turner, Mr. Downing, Mr. Thackeray, Mr. Lewis, and Mr. Hollis respectively.)

It would thus appear that the readings obtained through the wooden model are sensibly the same as those obtained through the central cube in the ordinary manner, and that the discrepancy is due to a real difference between the lines of collimation of the central and excentric portions of the object-glasses of the Collimators; and the application of a correction to the "concluded reading for collimation," as deduced from an adjustment of the North Collimator through the cube, is accordingly justified.

With regard to the observations before 1874 which were not so corrected, Sir George Airy remarked that for clock stars and other fundamental stars near the equator, the effect of the correction was merely differential, and therefore almost insensible, and even for other stars is a small quantity.

It may be remarked generally that this investigation suggests that the use of excentric pencils of light in observations of this kind, without proper care, is liable to introduce unexpected errors.

On the Protuberances Visible on the Spectrum with a Narrow Slit.
By E. L. Trouvelot.

At the last meeting of the R.A.S., March 12, Mr. Maunder read a paper containing some criticism on a spectroscopic observation of mine, published in the January number of the *Bulletin Astronomique*. After having described the observation Mr. Maunder said: "I think it is sufficient merely to state this observation to show that there must be some mistake somewhere." Further on he continued: "But the most important thing is that he saw the prominence not only when the slit was open but when it was closed," and he concluded by saying that "the observation was evidently impossible."

If I understand correctly the objections, according to Mr. Maunder, the observation was impossible: 1st, because a protuberance having a certain height, say 3′ 37″, cannot be seen with a slit open wide enough to admit it; and, 2nd, because such a prominence cannot be seen whole with a narrow slit. I must confess that these objections, coming as they do from an experienced observer, have caused me quite a surprise, for the first phenomenon is not so difficult to detect even on ordinary occasions; and the second is not so rare that a diligent observer might not see it at least once or twice in the course of a year. That protuberances projecting upon the spectrum have not yet been seen by Mr. Maunder is quite possible, since these forms of prominences are rare and have usually a short duration; but I am at a loss to understand why he should have failed to see protuberances 3′ high with a wide-open slit, when I can see them so easily, for, I suppose, the instruments he uses for his observations are equal to mine. I will state that in ordinary circumstances—that is, when the sky is passably clear

and the prominences tolerably bright—I make my daily drawings of these objects with a tangential and wide-open slit, permitting the whole form to be seen at a glance. In this way I have often drawn prominences 3′ and 4′ high, and indeed I have sometimes thus recognised the complicated structure of protuberances having twice this height. Of course the brightness of these objects diminishes with the widening of the slit, and the conditions of seeing vary with the clearness of the sky, the brightness of the prominences, and the aperture and perfection of the instruments employed. But here we only refer to ordinary hydrogen protuberances, which are not very bright; while those seen on the spectrum, which all belong to metallic eruptions, are usually so very brilliant that their structure is very distinct with a wide-open slit.

The projection of large prominences on the spectrum, such as those of Sept. 10, 1872, and of June 26, 1874, are very rare, and they are indeed so much so that these are the only cases which came under my observation in a daily experience of fifteen years with the spectroscope; but the smaller forms of projections, having an elevation from 30″ to 60″, and even 80″, are not so rare, and on an average I have observed them two or three times every year. I am persuaded that if Mr. Maunder be cautious to cover his head with a veil, and allow a few minutes for his eye to get accustomed to darkness, he will see prominences with a wide-open slit as I do; and if he be assiduous and patient, it will not be a very long while before he sees a bright and well-formed protuberance on the spectrum, although the slit of his spectroscope will be narrow and almost closed. I do not know whether Mr. Maunder has founded his objections on any other grounds than those above quoted, and reported in the *English Mechanic* for March 19, p. 51, where I read them. But, supposing he has other reasons, I do not see that it would change anything in the observed phenomenon; the fact will remain unchanged. I think it would be quite surprising if the remarkable phenomenon I have observed for the last thirteen years, and described more than eight years ago, had not been seen by at least a few of the numerous observers looking daily at the Sun. If it has not, it may be expected that it will soon be recognised now that the attention of observers is awakened. As far as can be judged from the brief postscript added to the note of M. Tacchini, "sur la distribution en latitude des phénomènes solaires pendant l'année 1885," published in the *Comptes Rendus*, March 15, 1886, it would appear that the phenomenon in question has been recently recognised by this observer. The P.S. reads thus:—"Les 9 et 10 Mars courant, j'ai observé au bord ouest du soleil, des éruptions métalliques très-singulières, dont la matière projetée et tout à fait éblouissante rendait comme continue et très-vive une portion du spectre à partir de la raie C vers D, et l'apparence était celle d'une protubérance vue devant le spectre." On March 9, at 10 A.M., I observed a bright prominence situated at

261°, and following a group of Sun spots which passed on the other side the night before. This object, whose elevation was 2′, reversed a great number of metallic lines, and was so intensely brilliant that, with the slit over 2′ wide, it could be seen beautifully with all its complicated structure, not only on the hydrogen, magnesium, and helium lines, but also on the red line whose wave length corresponds to 6676·8 (?) It is very likely that it is in the vicinity of this object that the Italian observer saw the eruption above described, but he probably did not observe at the same time as I did, for although of a dazzling brilliancy, no projection on the spectrum except a slight deviation of the C line towards the violet end was seen at the time mentioned.

The following experiment made on the prominence form projected on the spectrum on Sept. 10, 1872, may have some interest, and will perhaps throw some light on the subject. The C line was made tangent to the Sun's border, just as shown on fig. 12 of my last Paper, only the slit was made so narrow that the C line appeared sharp and black. The narrowing of the slit did not prevent the protuberance remaining wholly visible on the spectrum, as I have said before. The telescope being clamped, and the clock in motion, the C line and Sun's limb kept relatively together during the experiment; then, by means of its proper screw, the slit was moved away from the Sun's limb, sliding along the prominence form from its base to its summit. As the slit advanced the lower part of the prominence became invisible, being hidden as it were by the portion of the spectrum situated on the less refrangible side of the C line, which was by no means diaphanous for it, like the portion on the opposite side of the same line. As the slit continued to advance, only the upper portion of the prominence situated on the most refrangible side of C remained visible, and it disappeared when the slit reached its summit. It is to be noticed that although the protuberance was bright on the spectrum, it was entirely invisible on the dark C line, except at one or two places where it was seen crossing this line, and even advancing a little on the spectrum towards the red end. The same phenomenon was also observed on the prominence of June 26, 1874, but then the displacement on the opposite side of the projection was at places quite considerable.

Whatever may be the cause of this singular phenomenon, which as a positive fact will stand, I am not prepared at present to discuss, but it is certain that, as far as my observations go, it agrees well with the theory attributing it to the motion of the source of light in the line of sight.

Note on M. Trouvelot's Paper. By E. W. Maunder.

It is to be regretted that M. Trouvelot did not wait until he had seen the actual text of my paper before replying to it, as the report on which he based his reply was a very inaccurate one. I did not call in question his ability to see the whole of a large prominence at once through a widely opened slit, nor even the possibility of his seeing an entire prominence projected on the spectrum. But I pointed out that one of his observations, taken as it stood, involved, according to the accepted interpretation of the displacement of lines in prominence spectra, that the prominence in question was moving with every conceivable velocity from rest up to 2,584 kilomètres per second. We cannot imagine the possibility of such a state of things, of a body being at one and the same time in a state of rest, of gentle motion, and of rapid motion; clearly either the observation must be incorrect, or the interpretation of it.

M. Trouvelot's present paper makes it clear, I think, that it is the observation that is in fault. Taken as it stands it amounts to the assertion that with a slit only a few seconds wide, and placed tangentially close to the Sun's limb, he was able to see an object nearly $2'$ away from the limb, or much more than $1\frac{1}{2}'$ outside his slit. In other words, that on occasion he is able to see a prominence through the solid metal of his slit-plate; or rather through one plate of his slit, for whilst one plate was diaphanous to the prominence the other remained opaque.

It is clear that there is some error in the report of such an observation. Probably, and this would account for the entire phenomenon, the slit, when M. Trouvelot tried to close it, refused to answer its screw, as slits will occasionally, and therefore remained fully open during the entire observation. However this may be, it is clear that any spectrum can only correspond to the light actually admitted through the slit, and that the displacement of lines *within* that spectrum cannot bring within the range of the slit objects that are placed far outside it.

For observations of displacements of the lines of prominences M. Trouvelot would find a narrow radial slit much preferable to a wide tangential one, and if instead of reversing his spectroscope as a check on his observations he had made his slit radial, he would at once have seen whether these marvellous displacements were real or not.

On the Semi-diameter of Venus. By W. G. Thackeray.

(*Communicated by Mr. Downing.*)

In the *Monthly Notices*, vol. xxv. p. 57, Mr. Stone has discussed the observations of *Venus* with the Greenwich Mural and Transit Circles for the years 1839–62. Assuming that the error arising from personality is sensibly eliminated when the number of observers is considerable, and that it is practicable when the number of observations are sufficiently numerous to separate the constant part of the diameter due to the instrument from the part which varies with every change in the planet's distance, he obtained a correction to be applied to the *N.A.* semi-diameter when a single limb only was observed—

$$\text{viz. } +0''.392 \quad +(0.0269 \times N.A. \text{ semi-diameter.})$$

a correction which has been applied to the Greenwich observations when needed up to the present time. In 1865 Encke's value (8″·305) of the semi-diameter at the mean distance of the Sun from the Earth was used in the *Nautical Almanac*, instead of the value previously used, 8″·250. Let 8″·305 $(1+y)$ be the true semi-diameter, and let x be the constant quantity by which the computed diameter would require to be corrected to agree with the observed diameter. Then, $x+(1+y)$ *N.A.* diameter = observed diameter. Taking the values of the *N.A.* and observed vertical diameters, as given in the planetary results of the Greenwich observations for the years 1866–84, and separating the observations into two classes, those above 20″ and those below 20″ in diameter, by simple summation, we get two equations for the determination of the values of x and y:—

$$302x + 10192{\cdot}2y = 431{\cdot}66$$
$$590x + 7629{\cdot}4y = 757{\cdot}75$$

from which we obtain

$$x = +1''.196 \pm$$
$$y = +0.0067 \pm$$

This gives the value of the semi-diameter at the mean distance of the Sun from the Earth = 8″·360, and the correction to be applied in the case of a single limb being observed becomes

$$+0''.598 + (0.0067 \times N.A. \text{ semi-diameter}).$$

Now let us assume that the error of personality is not sufficiently eliminated by the number of the observers, and only use

the observations made by the four regular observers at the present time, we then get

		Above 20″.	Below 20″.
A. D.	(1873–84)	$25x + 742{\cdot}5y = 46{\cdot}27$	$70x + 891{\cdot}1y = 112{\cdot}79$
T.	(1875–84)	$19x + 611{\cdot}8y = 29{\cdot}07$	$59x + 758{\cdot}6y = 43{\cdot}91$
L.	(1881–84)	$18x + 570{\cdot}3y = 13{\cdot}23$	$11x + 130{\cdot}8y = 2{\cdot}71$
H.	(1882–84)	$5x + 177{\cdot}4y = 14{\cdot}21$	$20x + 254{\cdot}3y = 13{\cdot}87$
		$67x + 2102{\cdot}0y = 102{\cdot}78$	$160x + 2034{\cdot}8y = 173{\cdot}28$

from which we obtain

$$x = + 0''{\cdot}776 \pm$$
$$y = + 0{\cdot}0241 \pm$$

This gives semi-diameter at the mean distance of the Sun from the Earth 8″·505, and the correction to be applied to a single limb becomes +0″·388+ (0·0241+*N.A.* semi-diameter), a correction which happens to agree very closely with the one at present applied. Now, considering that the first set of equations refer to a considerable number of observations and observers, it would seem that the value of x is not independent of the error of personality, and that the value of y does vary with the change in the planet's distance; and if we solve the different equations referring to the different observers, we get

		Mean Semi-diameter.
For A. D.	$\begin{cases} x = + 1''{\cdot}432 \pm \\ y = + 0{\cdot}0141 \pm \end{cases}$	8″·422
T.	$\begin{cases} x = + 0{\cdot}180 \pm \\ y = + 0{\cdot}0426 \pm \end{cases}$	8·659
L.	$\begin{cases} x = - 0{\cdot}049 \pm \\ y = + 0{\cdot}0248 \pm \end{cases}$	8·511
H.	$\begin{cases} x = - 0{\cdot}506 \pm \\ y = + 0{\cdot}0943 \pm \end{cases}$	9·088

From these values it would appear that the amount of personality involved in the observation is much greater than the correction due to the instrument; and that, though a greater number of observers may be likely to give a more accurate value and compensate one another, it is just as likely that they should not.

On the Orbit of α Centauri. By E. B. Powell.

In two papers, published respectively in the *Monthly Notices* for November 1884 and March of the current year, I have assigned grounds for the conclusion that a period of some 76 years will not satisfy the imperfect observations of *α Centauri* taken in past centuries, and those made with fixed instruments in the early portion of the present one, and that a time of revolu-

tion of 86 years or upwards is required for this purpose. I now do myself the pleasure of laying before the Society a set of elements for that binary, with a period somewhat exceeding 87 years, which appear to satisfy fairly the recorded equatorial measures.

The calculations made by me upon the subject have been rather numerous. After arriving at an orbit which afforded a moderately fair representation of the motion from 1834 to 1884, eighteen epochs were selected as giving measures of apparently very considerable accuracy, and at the same time pertaining to telling points in the perspective ellipse. Variations of position-angle were then found for variations in the elements corresponding to the selected epochs; and, finally, equations of condition were formed and solved by the method of least squares. By taking at first some of the elements, P, τ and e for example, finding and applying the corrections thus afforded, and then determining the corrections of the remaining elements from the residual errors, orbits differing slightly were arrived at. The corrections of all the elements were also found simultaneously. In no case did P come out less than 86 years, and in only one was a considerably greater value obtained; this last value, which was afforded by the simultaneous solution of the equations for all the elements, I considered inadmissible for reasons connected with the early notices of the star, though the set of elements to which it belonged somewhat reduced the magnitude of the differences between observation and calculation for the eighteen epochs. Ultimately the elements given below were adopted. Of these, P and τ were obtained from ten equations of mean motion formed by combining different pairs of measures corresponding to considerable intervals of time, no interval being less than 25·8 years. The different values of P and τ thus found agreed well with one another, only one value of P falling so low as 86 years, two slightly exceeding 88, and the rest lying between 87 and 88 years. The remaining elements were determined by applying the method of least squares to the variation equations, using the residual errors of position after correcting for P and τ. Finally, the semi-major axis was found from eighteen measured distances. The extreme values were 19″·287 and 18″·259; the mean of the whole is the value adopted.

Elements.

$P = 87{\cdot}438$ years.

$\tau = 1875{\cdot}447$.

$e = {\cdot}544326$.

$\gamma = 79^\circ\ 47'\ 8''$.

$\Omega = 25^\circ\ 49'\ 38''$.

$\lambda = 48^\circ\ 59' - 17''$, $\hat{\omega} = 37^\circ\ 21'\ 9''$.

$a = 18''{\cdot}89$.

It may be noticed that, along with an increase of P, besides obtaining a larger value of a, we get an earlier time of periastron passage and an augmentation of the eccentricity.

Comparison of Observation with the results afforded by the above Elements.

Observer.	Epoch. 1800+	θ_o °	d_o "	$\theta_o - \theta_o$ °	$d_o - d_o$ "
Herschel	34·790	218·55	17·4	− ·72	−·41
Herschel	37·345	220·73	16·20	− ·48	·00
Jacob	47 090	235·10	9·45	− ·39	+·38
Jacob	48·010	238 00	8·03	− ·15	−·33
Maclear	50·313	247·07	6·75	− ·19	+·12
Maclear	51·565	254·42	5·88	− ·02	+·12
Maclear	52·793	263·31	4·99	− ·48	·00
Maclear	53·503	271·03	4·68	+ ·52	+·05
Jacob	54·391	281·38	4·30	+1·03	+·03
Powell	54·631	283·47	—	+ ·19	—
Powell	55·047	289·05	4·12	+ ·46	+·03
Maclear	55·357	291·96	4·38	− ·75	+·35
Maclear	56·022	302·13	3·95	+ ·31	−·03
Jacob	56·209	304·24	4·02	− ·77	+·04
Jacob	56·922	315·30	3·96	+1·20	−·10
Maclear	57·390	320·60	4·47	+ ·44	+·30
Jacob	57·991	327·49	4·24	+ ·08	−·12
Jacob	58·272	330·60	4·38	+ ·05	−·10
Maclear	59·228	339·42	5·09	− ·62	+·15
Maclear	60·183	349·34	—	+1·60	—
Maclear	60·346	348·87	5·59	− ·03	−·01
Powell	60·479	348·70	5·60	−1·11	−·08
Maclear	61·090	353·65	6·09	− ·03	+·01
Powell	62·205	358·00	6·79	−1·56	−·04
Maclear	62·560	1·38	7·55	+ ·21	+·48
Powell	63·028	1·40	7·20	−1·73	−·19
Ellery	63·750	5·20	8·50	− ·64	+·63
Powell	64·110	5·7	7·85	−1·37	−·26
Powell	66·063	11·10	9·30	−1·61	+·01
Powell	70·100	20·45	10·24	− ·95	−·27
Russell	70·746	22·32	10·46	− ·37	+·03
Powell	71·310	23·70	9·80	− ·14	−·46
Russell	72·468	25·33	9·73	−1·05	+·11
Russell	73·331	28·07	9·50	− ·52	+·66

Observer.	Epoch. 1800+	θ_o °	d_o "	$\theta_o - \theta_o$ °	$d_o - d_o$ "
Ellery	74·150	30·50	8·00	− ·66	+ ·16
Lindsay	74·850	34·17	—	+ ·14	—
Seelinger	75·020	34·21	6·82	− ·66	+ ·31
Russell	76·411	46·97	4·35	+ ·43	+ ·39
Ellery	76·615	51·05	4·15	+ 1·35	+ ·58
Maxwell Hall	77·140	64·40	3·30	+ 2·34	+ ·69
Russell and Gill*	77·602	81·46	1·97	− ·95	+ ·03
Gill	77·848	97·57	1·79	− 1·18	+ ·07
Maxwell Hall	78·380	139·10	2·4	+ ·65	+ ·56
Ellery	79·252	174·40	3·41	+ 1·70	+ ·21
Tebbutt	80·186	186·70	4·97	+ 1·23	− ·05
Tebbutt	81·655	193·15	7·95	− ·40	+ ·09
Gill and Elkin	83·500	198·00	10·70	− ·14	− ·37
Tebbutt	84·533	199·80	12·93	+ ·05	+ ·27
Tebbutt	85·580	201·02	14·20	− ·01	+ ·06

In testing the elements, all the available observations have not been used. It seemed to me that the number taken, spread as they are over the whole circuit, would suffice to give a correct idea of the degree of correspondence between the orbit and observation. A comparison has not been made in the case of the Sydney observations subsequent to 1877, since it appears, as Mr. Downing has observed, that some influence must have operated to throw out these measures from accord with those taken at other Observatories. It also seemed that no object would be attained by introducing the Melbourne observation for 1876·94 into the comparison, as the position-angle is practically the same as that given by the observation at the same place for 1876·615, while the motion of the comes during the interval must have been about 6°; for the earlier date also there are two sets of position-measures, while for the later there is only one. In two or three cases, where an observer did not take a measure of distance contemporaneously with his position-measure, but observed the distances for closely adjacent epochs, the distance for the epoch belonging to the angle has been found by proportion.

I may remark that the orbit now submitted agrees fairly with the notices of the binary in past centuries, with the exception of Maskelyne's observation of distance, and La Caille's measures of Diff. Declination and Diff. Right Ascension; it also accords with the Declination measures of the early part of this century, save in the case of Fallows. The disagreement in these instances, as was urged in my recent Papers on the period of *α Centauri*, cannot well be held of much weight.

* Russell ·596, 81°·7, 1″·9; Gill ·609, 81°·23, 2″·02.

In conclusion, while I consider that the evidence is tolerably strong against the period of this binary being only some 76 years, I by no means assert that the time of revolution is precisely 87·438 years. I hold that several years of observation will be required to fix quite accurately the values of P, τ, and e; but, from the annexed Table, I think it is evident that in six or eight years, if careful measures be taken, the point will be settled as to whether the period is about 76 years or exceeds 86 years.

Epoch.	Downing-Elkin Orbit. P.	*d.*	Orbit now submitted. P.	*d.*
	°	″	°	″
1886·275	202·61	14·89	201·74	15·04
1889·275	205·16	17·70	204·10	18·30
1892·275	207·11	19·52	205·82	20·68
1895·275	208·79	20·54	207·24	22·33
1898·275	210·37	20·91	208·49	23·39
1901·275	211·93	20·74	209·65	23·93

Hampstead: April 1886.

The Magnitude of η Argûs in March 1886.

By W. H. Finlay, M.A.

I have examined the magnitudes of the stars in the neighbourhood of *η Argûs*, and compared them amongst themselves on several occasions recently, with the following result:—

The letters used to denote the stars are those given by Sir John Herschel on pp. 44–46 of his "Results of Astronomical Observations at the Cape of Good Hope." My observations for the magnitude of *Eta* (A) are

$$\mathrm{A}\begin{cases} = \mathrm{F} \\ = \mathrm{F} \\ \text{slightly} < \mathrm{F} \end{cases} \quad \begin{cases} < \mathrm{O} \\ < \mathrm{O} \end{cases} \quad \begin{cases} > \kappa' \\ = \kappa' \end{cases} \quad \begin{cases} > \mathrm{C} \\ \tfrac{1}{2}\ \text{mag.} > \mathrm{C} \end{cases} \quad \begin{cases} \text{slightly} < \beta. \end{cases}$$

I also note β *very* slightly $< \lambda$.

The magnitudes of these stars, as given by Herschel himself and by Gould in the Cordoba Catalogue, are

	Herschel.	Gould.	
F	8	8	whence η is not very different from $7\frac{1}{2}$ magnitude.
O	7	$7\frac{1}{2}$	
κ'	8	8	
C	8	—	
β	8	$7\frac{1}{2}$	
λ	7	$7\frac{1}{2}$	

The stars F, β and λ, however, are among those whose magnitudes were specially determined by Gould for comparison with η (*cf. Uranometria Argentina*, p. 256), and they are there given as 7·60, 7·48, and 7·44 respectively. As they have maintained their relative magnitudes, we may assume the actual magnitudes to be still the same; and my observations, therefore, make the magnitude of η *Argûs* at the present time very approximately

7·6

in Gould's scale of magnitudes.

Royal Observatory, Cape of Good Hope:
1886, *March* 16.

The Nebulæ in the Pleiades. By A. A. Common.

The photograph of a part of the *Pleiades*, by MM. Henry, referred to in their letter to Mr. Knobel in the last number of the *Notices* of the Society, is very interesting. That MM. Henry set out with the intention of photographing the nebula near *Merope*, that is so well known, may be taken for granted; that they should evidently fail to get this, and get evidence of three separate nebulæ all near bright stars, only one of which can be said to have been certainly seen before, this being the same one near *Merope* that I found with the 3-foot Reflector in 1880 (*Monthly Notices*, April 1880), is very remarkable, and is due to the greater power of the photographic method over the eye in recording the presence of a faint light in the neighbourhood of a bright one.

On referring to my note of the observation of the small nebula near *Merope*, I have said: "There is strong suspicion in my mind of more nebula here," and I mention, "a similar appearance elsewhere" to that of this nebula. This I believe alluded to an observation of the Maia nebula which will be doubtless easily seen in the 3-foot telescope, and was the cause of the observation in the last paragraph of my note, where I say there is a great deal yet to be settled as to the extent and number of the nebulæ in this cluster.

Whether the fainter well-known nebula can be photographed with a telescope so small as that used by MM. Henry remains to be seen. There is an extremely small amount of light available, the light of this nebula being, I believe, not so bright as the zodiacal light at a considerable elevation, whilst the faintest trace of skylight quite obliterates it. Observations made at this time of year would, I feel sure, render it very doubtful if this nebula could be seen with any aperture, and it may be that this would account for it not being seen by some observers who have only looked for it at this time of the year.

Introduction to a Catalogue of the Colours of 1,730 *Stars.*

By W. S. Franks.

The observations detailed in the Catalogue of Star Colours, herewith presented to the Society,* were commenced on Oct. 31, 1884, and continued until March 10, 1886. Two telescopes were employed, both of them Newtonian reflectors, and equatorially mounted—the specula, by Calver, of $11\frac{1}{4}$-inch and $5\frac{1}{4}$-inch aperture, with foci of 80 inches and 40 inches respectively. The smaller instrument was reserved for stars between $+54°$ and the Pole, which the larger telescope, from its peculiar style of mounting, could not reach. The eyepieces used were of the "Kellner" construction, giving powers of 90 and 200 on the $11\frac{1}{4}$-inch, 45 and 100 on the $5\frac{1}{4}$-inch; the lower power had a field of $40'$ on the former, and $1°$ on the latter instrument. The higher power was only used for *double* stars. The magnitudes provisionally employed were derived from Heis, and, on the whole, they were found to be fairly accurate. A few obvious discrepancies were, however, met with, and duly recorded in the column headed "Remarks"; though particular attention to magnitude determinations was scarcely thought of, after the elaborate photometric researches so recently undertaken by Professors Pickering and Pritchard. All stars down to the 6–5 magnitude of the *Atlas Cœlestis Novus* (between $-20°$ and $+90°$) were examined, besides a few others of 6 magnitude, which were added during the prosecution of the work, being, in most cases, such as were in the immediate vicinity of the objects under examination. The constellation boundaries adopted were also from Heis, and in such instances where they differed from those of the B.A.C., a note to that effect was inserted under "Remarks." Every star common to the present catalogue and the previous one (1877-8) has been compared, and where any serious difference was detected the same was duly entered in its proper place. Some of the violent discordances alluded to may probably be due to defective identification, the 1877-8 series having been taken directly from the atlases of Proctor and the S.D.U.K., and the finder as often used in the search as the circles. But, in the present list, every star has been separately identified by circle readings; and it is therefore likely to be the more trustworthy of the two series. On the whole, however—and considering that the two sets were made with telescopes of different construction, with a wide difference in aperture—the old and new observations are fairly accordant, and within the usual limit of error.

In connection with the subject of star colours it may be worth remark that many stars were found to be distinctly *yellower* in twilight than on a dark sky; also that slight fog or haze had the effect of intensifying the yellow tints, especially, of course, towards the horizon. And, further, when collating the

* The Catalogue is placed in the Library.

present observations with those made in 1877–8 (Catalogue of 3,890 Stars) a systematic difference was clearly manifested, inasmuch as the $11\frac{1}{4}$-inch reflector made most objects with a yellow or orange tint distinctly *paler* than they were seen with the 5-inch achromatic—apparently due to the difference in the light-grasping power of the two telescopes, rather than to their different construction. From a careful series of comparisons which I made some years ago, between a refractor and reflector mounted side by side, with the apertures arranged so as to be precisely equivalent, I do not believe there is any appreciable difference between the colour results given by a reflector and a well-achromatised refractor of similar light-grasping power. On comparing the percentages given in the Appendix to the Catalogue (Table 2), it will be seen that, out of a total of 52 constellations, 42 show a *higher* percentage of "white" stars, and 36 a *lower* percentage of "orange" stars, for the 1884–6 than for the 1877–8 series. This and the preceding facts seem to point to the conclusion that the *colour* of stellar light is affected, to a certain extent, by its intrinsic *brightness* also. And another circumstance, which does not appear to have hitherto attracted attention, tends to confirm this view. It is that those constellations having many *bright* stars are, as a rule, remarkable for their high percentage of "white"; whilst in those constellations where there are many *small* stars, and relatively few bright ones, the "yellow" and "orange" tints are most abundantly found. The question of colour distribution in the sidereal heavens has, so far, received but scant attention from astronomers, notwithstanding the interesting nature of the inquiry, and that it might be made to yield important evidence respecting the constitution and structure of the stellar universe. It is a fact worthy of remark that most of the constellations with a high percentage of *white* stars, such as *Cassiopeia*, *Perseus*, *Taurus*, *Orion*, *Scorpio*, *Lyra*, &c., are associated with the galaxy. The late Prebendary Webb had noticed the absence of coloured stars as regards *Taurus*; and Padre Secchi, from spectroscopic observations, found that stars with spectra of the first (Vega) type prevailed in *Lyra*, *Taurus*, and *Orion*. The latter observer also remarked that the second (Aldebaran) type was abundant in *Cetus*, *Cepheus*, *Draco*, *Eridanus*, &c.; but the last-named constellation is, according to my observations in 1877–8 and 1884–6, rather remarkable for "white" than "yellow" stars. The *yellow* and *orange* coloured stars appear to be generally most plentiful in large straggling constellations, such as *Cetus*, *Pisces*, *Hydra*, *Leo*, *Virgo*, *Boötes*, *Draco*, *Aquila*, &c.; whilst the rich compact asterisms are distinguished for their number of *white* stars. Beyond this it does not seem possible at present to indicate any general law that governs the distribution of stellar colours, though it is much to be desired that with a better means of registering star tints than is afforded by mere eye-estimation, some effort should be made in the future to throw light upon this interesting though obscure

point. As illustrating the fact, previously referred to, of the systematic discordancy between the colour estimates of 1877–8 and 1884–6, the Appendix shows that the *mean* percentage of white, yellow, and orange stars is as follows:—

55·2 white, 35·2 yellow, 9·6 orange, from 1,744 stars in 1884–6 catalogue.

48·6 „ 36·8 „ 14·6 „ „ 1,641 „ „ 1877–8 { which are common to both lists.

46·0 „ 38·1 „ 15·9 „ „ 3,816 „ „ 1877–8 catalogue.

As the larger number of stars in the 1877–8 series confirms the smaller number common to both lists, it is evident that, in any future observations the *aperture* of the telescope will have to be considered as a modifying factor in the final result.

A few words of explanation will suffice respecting the arrangement of the present catalogue. Instead of the usual arbitrary order in R.A., which could give but little idea of the grouping of colours in particular regions of the heavens, the stars are arranged in *constellations*, according to the "Index-plan;" from which it will be seen that they are divided into twelve groups, each group commencing at the southern limit and ending at the most northern. This was done, in the first place, for convenience in observing; and it has been retained because it seemed an improvement over the older plan. No difficulty need arise in finding any required object, since the constellation page is there given, and the stars in each constellation are in R.A. order. In addition to the "Symbols and Abbreviations" given on the same page as the Index-plan, a few others have been employed, as follows: "brt."=bright; "wh."=white; "blsh."=bluish; "grnsh."=greenish; "yelsh."=yellowish; "yel."=yellow; "or."=orange. And the "Explanation of Terms used in designating Star Colours" may be of service in giving a more precise definition of the intended meaning. Column I. of the catalogue gives the *name* of star; column II. its *number* in the "British Association Catalogue;" columns III. and IV. the *R.A.* and *Decl.* for epoch 1880 (these are approximate merely, but quite sufficient for identification); column V. gives the *magnitude*, from Heis' "Catalogus;" column VI. the *colour*, as observed with the $11\frac{1}{4}$-inch or the $5\frac{1}{4}$-inch telescope; column VII. the *date* of observation, together with *remarks*—the magnitudes in this column, when following a "double" or "triple" star, are from Struve's "Mensuræ Micrometricæ."

The positions of 1,730 stars are given in the catalogue, but the total number of stars included is 1,893, the balance being due to the *comites* of multiple stars. Some 72 stars, chiefly from Bode and Lalande, appear in this catalogue for the first time; all the others are contained in my former list of 3,890 stars (1877–8). The "double" stars were, as a whole, observed before the others; this being part of a previously arranged survey of all the sidereal portion of Webb's "Celestial Objects."

As considerable care was devoted to these double stars it was thought advisable to include the *colours* of their *comites* in the present list—at least, such as were above 9 mag.

The "Appendix" contains a table, giving an analysis of all the colours of the 1,893 stars (reproduced at the end of this paper); and a second table, in which the percentage of "white," "yellow," and "orange" stars only, is given. For the purpose of comparison, the percentage results of the stars common to the catalogues of 1877–8 and 1884–6, and also those obtained from the whole of the stars in the former catalogue, are appended. An attempt has been made on the map which accompanies the catalogue to give a graphic delineation of the manner in which the white, yellow, and orange stars are distributed in the N. hemisphere; it includes about 1,400 stars.

Analysis of the Colours of Stars contained in the Catalogue (Table I., Appendix).

Constellation.	White.	Yellow.	Orange.	Red.	Green.	Blue.	Purple.	Others.	Total.
Cetus	23	18	4	—	—	1	2	—	48
Pisces	15	28	6	2	—	1	—	—	52
Andromeda	21	15	4	—	1	—	—	—	41
Cassiopeia	25	15	2	1	—	2		1	48
Eridanus	20	10	5	—	1	—	—	—	36
Aries	26	10	—	1	—	1	1	—	39
Triangula	7	6	—	—	1	—	—	—	14
Taurus	50	13	4	—	1	3	4	—	75
Perseus	31	14	5	—	—	2	1	—	53
Lepus	7	3	—	—	1	—	—	—	11
Orion	44	10	4	1	—	6	2	—	67
Auriga	18	13	5	—	—	1	3	—	40
Camelus	25	10	4	—	—	3	1	—	43
Canis Major	7	4	2	—	1	—	—	—	14
Monoceros	24	8	3	—	—	1	1	1	38
Canis Minor	5	4	1	—	—	2	—	—	12
Gemini	21	15	3	—	—	1	3	—	43
Lynx	12	5	—	1	—	—	3	—	21
Argo Navis	6	—	1	—	—	1	—	—	8
Hydra	10	9	4	2	—	—	1	—	26
Cancer	16	13	3	—	1	2	—	—	35
Leo Minor	9	7	2	—	—	—	—	—	18
Sextans	6	1	—	—	—	—	—	—	7
Crater	3	5	1	—	—	—	—	—	9
Leo	25	20	14	1	—	2	4	1	67

Constellation.	White.	Yellow.	Orange.	Red.	Green.	Blue.	Purple.	Others.	Total.
Ursa Major	40	27	4	—	1	2	2	—	76
Corvus	5	1	—	—	—	—	1	—	7
Virgo	22	20	3	—	—	1	—	—	46
Coma Berenices	10	12	2	—	—	—	3	—	27
Canes Venatici	12	7	7	—	—	1	—	1	28
Libra	8	5	—	—	—	—	—	—	13
Boötes	29	23	4	—	—	1	6	—	63
Corona Borealis	10	9	2	—	—	1	1	—	23
Ursa Minor	8	7	1	—	—	—	—	—	16
Scorpio	7	2	—	—	—	1	1	—	11
Serpens	16	12	2	—	—	—	—	—	30
Ophiuchus	23	14	2	—	—	—	1	—	40
Hercules	47	23	12	—	2	—	1	—	85
Draco	40	32	9	—	—	4	3	—	88
Sagittarius	5	3	—	—	—	—	—	—	8
Aquila	28	22	3	—	—	—	1	—	54
Sagitta	3	5	1	—	—	1	—	—	1
Lyra	16	10	1	1	—	2	—	1	31
Capricornus	10	7	3	—	—	2	—	—	22
Delphinus	8	5	—	—	1	—	1	—	15
Equuleus	1	6	—	—	1	1	1	—	10
Vulpecula	16	9	2	—	—	1	—	—	28
Cygnus	45	29	10	—	3	6	3	2	98
Aquarius	29	17	4	—	—	3	2	—	55
Pegasus	28	30	11	—	—	—	1	—	70
Lacerta	12	3	5	—	—	—	—	—	20
Cepheus	28	18	3	—	—	3	2	—	54
Grand Total	962	614	168	10	15	59	58	7	1,893

Note on the Radiation of Meteors. By W. F. Denning.

In a short paper on the Biela meteors (*Monthly Notices*, Jan. 1886, p. 118) Mr. Proctor remarks that the diffuse character of the radiation "appears unquestionably due to changes of direction caused by atmospheric resistance," and then hastily assumes that a radiant-area of two degrees diameter cannot "safely be assigned to meteors having the so-called stationary radiants."

But Mr. Proctor quite misses the fact that these meteors of Biela's comet enter the atmosphere at the rate of only about eleven miles per second, while the apparent velocities of the very great majority of the other known meteor streams must average

at least thirty miles per second. The effects of air resistance in deflecting the courses must be vastly less, in the case of these swifter meteors, than that affecting the exceptionally slow meteors falling from γ *Andromedæ* on Nov. 27, where such disturbances will evidently reach a maximum. The nature of the radiation observed in regard to the latter is special* and cannot for a moment be supposed to represent that of meteor swarms generally. The shooting stars belonging to ordinary and fairly typical showers exhibit radiants confined to very limited areas; for in cases where the individual flights are recorded with great accuracy they are invariably found to intersect nearly at a point.

As to the stationary radiant points, which I confidently uphold as the unavoidable outcome of my observations, they cannot be obliterated from the sky but by more effectual objections than that such anomalies are not moulded according to the theories which have been imperfectly applied to a branch of astronomy of very modern date. If these radiants are inexact, or if a wrong construction has been put upon their singular affinities of grouping, the fact may be determined by further observation. We are not yet in a position to assume that our knowledge of theory comprehends every possible form and condition of meteoric phenomena presented to the earth.

I cannot but feel indebted to Mr. Proctor for his frequent references to this subject, for it is likely to suffer most by that indifference and apathy with which complex details of observation are too often treated. But he will do best service by enforcing on observers the necessity of subjecting the disputed features to further critical investigation rather than by raising obstacles, many of which have no weight. We require not only careful re-determinations of the radiants, but new and reliable data as to the velocity of meteors. I believe that the tendency in past years has been to overestimate the durations, and that, were the records true to fact, many instances of hyperbolic fireballs (with their associated currents of small meteors) would have resulted from the computations. But though the speed, in certain cases, may have exceeded that which has been assigned, it is scarcely possible it can have been so great as that which Mr. A. C. Ranyard and others have pointed out as necessary to explain the occurrence of meteors from fixed, long-enduring radiants.

Bristol: March 15, 1886.

* Its diffuseness is admitted, but the meteors are so numerous that the central radiants, as deduced by different observers (many of whom may claim little experience in determinations of this sort), are in excellent agreement. See the comparative table of positions for the shower of November 27, 1885, compiled by the writer for the *Astronomical Register*, April 1886, pp. 95-6

Observations of Comets d, 1885 (Fabry), and e, 1885 (Barnard), made at the Royal Observatory, Greenwich.

(*Communicated by the Astronomer Royal.*)

The observations on March 11, March 23, April 1, and April 3, were made with the East or Sheepshanks Equatorial, aperture 6·7 inches, and those on March 9 with the Lassell Reflector, aperture 24 inches, by taking transits over two cross-wires at right-angles to each other, and each inclined 45° to the parallel of Declination.

Comet d, 1885.

Greenwich Mean Solar Time. 1886.	Observer.	✱−✱ R.A.	Corr. for Par. & Refract. in R.A.	✱−✱ N.P.D.	Corr. for Par. & Refract. in N.P.D.	No. of Comp.	Apparent R.A.	Apparent N.P.D.	Comp. Star.
d h m s		m s	s	′ ″	″		h m s	° ′ ″	
March 11 7 43 47	L.	+0 31·13	+0·16	+10 8·5	− 2·2	6	23 19 1·24	57 32 30·0	*a*
April 3 8 22 45	H.	−3 16·37	+0·03	− 6 25·6	−19·3	3	23 19 50·18	50 53 21·2	*b*

Comet e, 1885.

March 9 9 11 17	H. T.	+0 28·38	+0·24	− 0 26·5	− 3·9	4	1 54 15·62	66 41 56·5	*c*
23 8 40 49	H. T.	+0 8·08	+0·19	+ 7 5·0	− 2·8	5	1 51 38·96	62 9 18·5	*d*
April 1 8 39 8	H. T.	+1 2·75	+0·24	+ 1 19·4	− 3·9	4	1 50 16·67	58 56 31·5	*e*
3 9 16 39	H.	+0 41·77	+0·16	+ 2 42·0	− 2·9	3	1 49 51·72	58 10 47·1	*f*

Mean Places of Comparison Stars.

	Star's Name.	R.A. 1886·0. h m s	N.P.D. 1886·0 ° ′ ″	Authority.
(*a*)	W. B. (2) XXIII. 346	23 18 30·74	57 22 20·6	Weisse's Bessel (2).
(*b*)	W. B. (2) XXIII. 457	23 23 7·09	50 59 59·3	Weisse's Bessel (2).
(*c*)	Arg. Zone, +23° No. 266	1 53 47·45	66 42 22·3	Bonn Observations, Vol. IV.
(*d*)	W. B. (2) I. 1168	1 51 31·25	62 2 13·1	Weisse's Bessel (2).
(*e*)	Arg. Zone, +30° No. 298	1 49 14·28	58 55 10·3	Bonn Observations, Vol. IV.
(*f*)	W. B. (2) I. 1095	1 49 10·41	58 8 2·2	Weisse's Bessel (2).

Notes.

March 9. (*e*). Comet near Moon, but easily seen in finder.
March 11. (*d*). Comet very bright; a slight condensation to right of centre. No tail visible.
April 3. (*d*). Comet very bright.

The observations are corrected for parallax and refraction. The initials HT., L., and H., are those of Mr. Turner, Mr. Lewis, and Mr. Hollis respectively.

Errata in Monthly Notices, Vol. xlvi. *p.* 303.

In column "Corr. for Par. and Refract. in N.P.D.," *for* −4″·1, −2″·5, −4″·6, *read* −5″·4, −3″·8, −6″·1, respectively.

In column "Apparent N.P.D.," *for* 58° 43′ 15″·8 *read* 58° 43′ 14″·5.
„ 58 43 20·2 „ 58 43 18·9.
„ 58 43 8·9 „ 58 43 7·4.

Royal Observatory, Greenwich: 1886, *April* 9.

Observations of Occultations by the Moon, 1884–5, and of Eclipses of the IVth Satellite of Jupiter, 1885, made at the Radcliffe Observatory, Oxford.

(*Communicated by E. J. Stone, M.A., F.R.S., Radcliffe Observer.*)

Occultations by the Moon.

Ref.	Day of Obs.	Phenomenon.	Moon's Limb.	Instrument.	Power used.	G.M.T. of Observation. h m s	Observer.
	1884.						
(*a*)	July 3	Disapp. ζ Libræ	Dark	Equatorial	125	8 54 6·7	R.
(*b*)	Oct. 12	Reapp. 60 Cancri	,,	,,	110	17 30 14·5	R.
(*c*)	,,	Disapp. α Cancri	Bright	,,	,,	17 59 17·3	R.
(*d*)	Dec. 4	Reapp. λ Geminorum	Dark	,,	125	16 41 28·4	F. B.
	1885.						
(*e*)	Jan. 21	Disapp. B.A.C. 57	,,	,,	,,	5 37 45·3	R.
(*f*)	Feb. 20	Disapp. 38 Arietis	,,	Heliometer	200	7 41 10·9	W.
(*g*)	,,	,, ,,	,,	Equatorial	125	7 41 11·3	R.
(*h*)	,,	,, ,,	,,	Marlborough	80	7 41 11·0	F. B.
(*i*)	March 27	Disapp. B.A.C. 3529	,,	Equatorial	125	10 21 43·6	R.
(*j*)	,,	Disapp. 43 Leonis	,,	,,	,,	11 34 14·4	R.
	April 20	Disapp. λ Geminorum	,,	Dollond	80	10 58 3·8	R.
(*k*)	22	Disapp. B.A.C. 3122	,,	Equatorial	125	9 2 3·6	R.
(*l*)	,,	,, ,,	,,	Heliometer	200	9 2 3·3	F. B.
(*m*)	July 8	Disapp. Aldebaran	Bright (Near Mid-day)	,,	80	23 21 40·9	W.
(*n*)	,,	,, ,,	Bright	Equatorial	45	23 21 41·0	R.

Ref.	Day of Obs.	Phenomenon.	Moon's Limb.	Instrument.	Power used.	G.M.T. of Observation. h m s	Observer.
	1885.						
(*o*)	July 20	Disapp. o^2 Libræ	Dark	Equatorial	45	10 55 38·4	R.
(*p*)	22	Disapp. 29 Ophiuchi	,,	,,	,,	10 28 40·1	R.
(*q*)	Sept. 1	Reapp. B.A.C. 1391	,,	Heliometer	80	11 31 58·5	W.
	,,	,, ,,	,,	Marlborough	,,	11 31 60·0	F. B.
	,,	Reapp. 85 Tauri	,,	Heliometer	45	12 3 33·3	W.
(*r*)	19	Disapp. 13 Capricorni	,,	Equatorial	125	8 2 33·5	F. B.
(*s*)	,,	Disapp. 14 Capricorni	,,	,,	95	9 32 13·3	F. B.
(*t*)	21	Disapp. B.A.C. 7774	,,	Heliometer	45	10 6 29·3	W.
(*u*)	,,	,, ,,	,,	Equatorial	125	10 6 29·2	F. B.
(*v*)	Nov. 17	Disapp. B.A.C. 8365	,,	Heliometer	45	10 39 42·5	W.
(*w*)	,,	,, ,,	,,	Equatorial	160	10 39 43·1	R.
(*x*)	,,	,, ,,	,,	Dollond	45	10 39 43·4	F. B.
(*y*)	30	Disapp. *Uranus*	Bright	Equatorial	125	16 58 42·2	F. B.
(*z*)	,,	Reapp. *Uranus*	Dark	Heliometer	110	18 8 4·2	W.
(z_1)	,,	,, ,	,,	Equatorial	125	18 8 6·4	F. B.

Remarks.

(*a*) Image of star faint and diffused at times. Not a satisfactory observation.

For observations of occultations of Struve's faint stars during the Total Eclipse of Moon on 1884, Oct. 4, *vide Monthly Notices*, ol. xlv. No. 1.

(*b*), (*g*), (*n*), (*v*) Instantaneous.

(*c*) Very good image, but did not disappear instantaneously. Observation good.

(*d*), (*f*), (*h*), (*t*), (*u*) Good.

(*e*), (*k*), (*o*), (*p*), (*w*) Good. Instantaneous.

(*i*) Magnitude = $7\frac{1}{2}$, not 6, as in *N.A.* Faint and diffused.

(*j*) Instantaneous. This star is much brighter than (*i*).

(*l*), (*r*) Star was diffused, but observation fairly good.

Remarks (continued).

(*m*) Very good. (*q*) Bad image, hazy. Moon low down. (*s*) Diffused. Sky hazy. (*x*) Star diffused.
(*y*) Definition of Moon good; planet diffused; disappeared quickly. Probable error, $1^{s}\cdot5$.
(*z*) Good definition; may be a little late, perhaps $0^{s}\cdot5$.
(z_1) May be 1^{s} or 2^{s} late, as I was not looking at the exact point of reappearance on the invisible limb of the Moon. The time has been diminished 30^{s} on the assumption that the wrong end of the chronometer's second-hand was taken.

In converting Oxford Mean Solar Times into Greenwich Mean Solar Times, the following Longitude has been used: $5^{m}\ 2^{s}\cdot6$ *W.*

Eclipses of the IVth Satellite of Jupiter.

Ref.	Day of Obs.	Satellite.	Phenomenon.	Instrument.	Power used.	G.M.T. of Observation.	G.M.T. of *N.A.*	Observer.
	1885.					h m s	h m s	
(*α*)	Feb. 2	IV.	Ecl. Dis. Last seen	Equatorial	125	10 9 16	10 8 28	R.
(*β*)	19	„	Ecl. Re. First suspected	Heliometer	200	8 41 42	8 41 52	W.
	„	„	Ecl. Re. Confirmed	„	„	8 43 42		
(*γ*)	„	„	Ecl. Re. First seen	Equatorial	125	8 43 40	8 41 52	F. B.
(*δ*)	Apr. 27	„	„ „	Heliometer	160	8 34 51	8 35 43	R.
(*ε*)	„	„	Ecl. Re. Suspected	Equatorial	125	8 35 6	8 35 43	F. B.
	„	„	Ecl. Re. Verified	„		8 35 36		

Remarks.

(*α*) Satellite diminished very slowly in brightness.
(*β*) Reappeared, almost touching limb of *Jupiter*. Markings very distinct at times. Rather hazy. (*γ*) Very fair observation.
(*δ*) Observation good, but images slightly diffused. (*ε*) Definition bad at times, but very fair observation.

Observers: W. = Mr. Wickham; R. = Mr. Robinson; F. B. = Mr. Bellamy.
Apertures: Heliometer, 7·5-inch. Equatorial, 7-inch. Dollond, 3·8-inch. Marlborough, 3·3-inch.

Observations of Eclipses, Occultations, and Transits of Jupiter's Satellites, made with the 8-inch Cooke Equatorial at the Adelaide Observatory, South Australia: Longitude, 9h. 14m. 20s·3 E.; Latitude, 34° 56′ 33″·8 S.

(*Communicated by Mr. Todd.*)

Ref. No.	Date.	Observer.	Phenomenon.	Phase of Phenomenon.	Adelaide Mean Time.	Corresponding Greenwich Mean Time.	Time by *Nautical Almanac*.	Apparent Error of *N. A.*	Power used.
					h m s	h m s	h m s	h m s	
1	1885, Jan. 7.	C.	I. Tr. E.	Int. contact	11 5 6·7	1 50 46·4			200
2				Abt. bisected	11 7 13·7	1 52 53·4			,,
3				Ext. contact	11 10 12·5	1 55 52·2			,,
4	Jan. 15.	C.	I. Oc. R.	First seen	10 6 54·1	0 52 33·8			120
5				Ext. contact	10 10 46·3	0 56 26·0			,,
6	Feb. 16.	C.	II. Sh. E.	Int. contact	10 28 17·0	1 13 56·7			200
7				Abt. bisected	10 29 22·2	1 15 1·9			,,
8				Limb complete	10 30 47·7	1 16 27·4			,,
9	Feb. 16.	C.	II. Tr. E.	Int. contact	10 33 45·9	1 19 25·6			,,
10				Abt. bisected	10 35 18·4	1 20 58·1			,,
11				Ext. contact	10 37 35·7	1 23 15·4			,,
12	Feb. 21.	C.	I. Oc. D.	Ext. contact	10 53 42·8	1 39 22·5			,,
13				Abt. bisected	10 55 49·8	1 41 29·5			,,
14				Last seen	10 57 28·0	1 43 7·7			,,
15	Feb. 21.	C.	I. Ec. R.	First seen	13 15 27·6	4 1 7·3	4 0 59	−0 8	150±
16				Full blaze	13 17 27·6	4 3 7·3			,,

Ref. No.	Date.	Observer.	Phenomenon.	Phase of Phenomenon.	Adelaide Mean Time.	Corresponding Greenwich Mean Time.	Time by *Nautical Almanac.*	Apparent Error of *N.A.*	Power used.
					h m s	h m s	h m s	h m s	
17	1885, Feb. 22.	C.	I. Tr. I.	Ext. contact	8 9 49·7	22 55 29·4			150 ±
18				Abt. bisected	8 11 23·6	22 57 3·3			,,
19				Int. contact	8 14 36·8	23 0 16·5			,,
20	Feb. 22.	C.	I. Sh. I.	Limb indented	8 17 38·8	23 3 18·5			,,
21				Limb complete	8 20 35·5	23 6 15·2			,,
22	Feb. 22.	C.	I. Tr. E.	Int. contact	10 27 26·4	1 13 6·1			250 ±
23				Abt. bisected	10 29 54·3	1 15 34·0			,,
24				Ext. contact	10 33 6·9	1 18 46·6			,,
25	Feb. 22.	C.	I. Sh. E.	Int. contact	10 33 31·6	1 19 11·3			,,
26				Limb complete	10 35 47·7	1 21 27·4			,,
27	Feb. 23.	C.	II. Tr. I.	Ext. contact	9 55 30·9	0 41 10·6			150 ±
28				Abt. bisected	9 57 57·9	0 43 37·6			,,
29				Int. contact	10 2 30·9	0 48 10·6			,,
30	Feb. 23.	C.	II. Tr. E.	Int. contact	12 47 59·6	3 33 39·3			,,
31				Abt. bisected	12 50 54·6	3 36 34·3			,,
32				Ext. contact	12 54 2·6	3 39 42·3			,,
33	Feb. 23.	C.	II. Sh. E.	Int. contact	13 2 20·6	3 48 0·3			,,
34				Still indented	13 4 17·6	3 49 57·3			,,
35				Ext. contact	13 4 57·6	3 50 37·3			,,
36	Feb. 25.	C.	II. Ec. R.	First seen	8 5 29·3	22 51 9·0	22 51 26	+0 17	,,

Ref. No.	Date.	Observer.	Phenomenon.	Phase of Phenomenon.	Adelaide Mean Time.	Corresponding Greenwich Mean Time.	Time by *Nautical Almanac.*	Apparent Error of *N.A.*	Power used.
					h m s	h m s	h m s	h m s	
37				Quite distinct	8 5 56·4	22 51 36·1			150±
38				Full blaze	8 8 44·8	22 54 24·5			,,
39	1885, Feb. 28.	C.	I. Oc. D.	Ext. contact	12 36 6·7	3 21 46·4			,,
40				Abt. bisected	12 38 6·7	3 23 46·4			,,
41				Last seen	12 40 35·7	3 26 15·4			,,
42	Feb. 28.	C.	I. Ec. R.	First seen	15 9 18·5	5 54 58·2	5 54 57	−0 1	,,
43				Quite distinct	15 9 32·3	5 55 12·0			,,
44				Full blaze	15 13 22·3	5 59 2·0			,,
45	March 1.	C.	I. Tr. I.	Ext. contact	9 51 42·1	0 37 21·8			,,
46				Int. contact	9 56 54·7	0 42 34·4			,,
47	March 2.	C.	I. Ec. R.	First seen	9 38 5·2	0 23 44·9	0 23 27	−0 18	,,
48				Quite distinct	9 38 18·1	0 23 57·8			,,
49				Full blaze	9 42 18·1	0 27 57·8			,,
50	March 2.	C.	II. Tr. I.	Ext. contact	12 9 37·7	2 55 17·4			,,
51				Abt. bisected	12 12 7·7	2 57 47·4			,,
52				Int. contact	12 15 43·7	3 1 23·4			,,
53	March 2.	C.	II. Sh. I.						
54	March 4.	C.	II. Ec. R.	First seen	10 41 45·2	1 27 24·9	1 27 51	+0 26	200
55				Quite distinct	10 41 52·5	1 27 32·2			,,
56				Full blaze	10 45 47·5	1 31 27·2			,,

	Date.	Observer.	Phenomenon.	Phase of Phenomenon.	Adelaide Mean Time.	Corresponding Greenwich Mean Time.	Time by *Nautical Almanac*.	Apparent Error of *N.A.*	Power used.
					h m s	h m s	h m s	h m s	
57	1885, March 8.	C.	I. Tr. I.	Ext. contact	11 40 0·0	2 25 39·7			200
58				Abt. bisected	11 42 6·0	2 27 45·7			,,
59				Int. contact.	11 43 56·0	2 29 35·7			,,
60	March 8.	C.	IV. Ec. R.	First seen	11 53 45·0	2 39 24·7	2 39 47	+0 22	,,
61				Quite distinct	11 54 0·0	2 39 39·7			,,
62				Full blaze	11 58 40·0	2 44 19·7			,,
63	March 8.	C.	I. Sh. I.	First seen	12 6 21·0	2 52 0·7			,,
64				Int. contact	12 8 16·0	2 53 55·7			,,
65	March 8.	C.	I. Tr. E.	Ext. contact	14 0 33·8	4 46 13·5			,,
66	March 8.	C.	I. Sh. E.	Int. contact	14 21 6·7	5 6 46·4			,,
67				Still indented	14 24 12·7	5 9 52·4			,,
68				Limb complete	14 24 25·7	5 10 5·4			,,
69	March 9.	S.	I. Oc. D.	Ext. contact	8 47 32·1	23 33 11·8			,,
70				Abt. bisected	8 49 47·1	23 35 26·8			,,
71				Limb complete	8 51 7·1	23 36 46·8			,,
72	March 9.	S.	I. Ec. R.	First seen	11 31 47·7	2 17 27·4	2 17 36	+0 9	,,
73				Full blaze	11 35 56·7	21 21 36·4			,,
74	March 9.	S.	II. Tr. I.	Ext. contact	14 23 56·3	5 9 36·0			,,
75				Abt. bisected	14 26 26·3	5 12 6·0			,,
76				Int. contact	14 29 36·3	5 15 16·0			,,

Ref. No.	Date.	Observer.	Phenomenon.	Phase of Phenomenon.	Adelaide Mean Time.	Corresponding Greenwich Mean Time.	Time by *Nautical Almanac.*	Apparent Error of *N.A.*	Power used.
					h m s	h m s	h m s	h m s	
77	1885, March 10.	S.	III. Ec. R.	First seen	8 0 49·1	22 46 28·8	22 46 52	+0 23	200
78				Quite distinct	8 1 34·1	22 47 13·8			,,
79				Full blaze	8 6 34·1	22 52 13·8			,,
80	March 10.	S.	I. Tr. E.	Int. contact	8 21 29·1	23 7 8·8			,,
81				Ext. contact	8 26 9·1	23 11 48 8			,,
82	March 10.	S.	I. Sh. E.	Int. contact	8 50 19·0	23 35 58·7			,,
83				Limb complete	8 52 54·0	23 38 33·7			,,
84	March 15.	S.	I. Tr. I.	Ext. contact	13 22 39·3	4 8 19·0			,,
85				Abt. bisected	13 25 35·3	4 11 15·0			,,
86				Int. contact	13 28 50·3	4 14 30 0			,,
87	March 15.	S.	I. Sh. I.	Int. contact	14 3 0·3	4 48 40·0			,,
88	March 16.	S.	IV. Tr. I.	Ext. contact	9 2 57·0	23 48 36·7			,,
89				Abt. bisected	9 9 52·0	23 55 31·7			,,
90				Int. contact	9 16 47·0	0 2 26·7			,,
91	March 16.	S.	I. Oc. D.	Ext. contact	10 30 46·7	1 16 26·4			120
92				Limb complete	10 35 36·7	1 21 16·4			,,
93	March 16.	S.	I. Ec. R.	First seen	13 25 59·3	4 11 39·0	4 11 54	+0 15	,,
94				Full blaze	13 30 26·3	4 16 6·0			,,
95	March 16.	S.	IV. Tr. E.	Ext. contact	13 53 41·3	4 39 21·0			,,

Ref No.	Date.	Observer.	Phenomenon.	Phase of Phenomenon.	Adelaide Mean Time.	Corresponding Greenwich Mean Time.	Time by *Nautical Almanac*.	Apparent Error of *N.A.*	Power used.
					h m s	h m s	h m s	h m s	
96	1885, March 17.	S.	I. Tr. I.	Int. contact	7 57 4·8	22 42 44·5			200
97	March 17.	S.	I. Sh. I.	First seen	8 29 14·8	23 14 54·5			,,
98				Int. contact	8 31 39·8	23 17 19·5			,,
99	March 17.	S.	I. Sh. E.	Int. contact	10 44 24·5	1 30 4·2			,,
100				Still indented	10 47 9·5	1 32 49·2			,,
101				Limb complete	10 47 34·5	1 33 14·2			,,
102	March 17.	S.	III. Ec. R.	First seen	11 59 55·4	2 45 35·1	2 45 12	−0 23	120
103				Full blaze	12 5 44·4	2 51 24·1			,,
104	March 18.	C.	I. Ec. R.	First seen	7 54 45·1	22 40 24·8	22 40 30	+0 5	200
105				Quite distinct	7 54 56·9	22 40 36·6			,,
106				Full blaze	7 58 51·9	22 44 31·6			,,
107	March 18.	S.	II. Oc. D.	Ext. contact	11 39 41·3	2 25 21·0			,,
108				Abt. bisected	11 43 49·3	2 29 29·0			,,
109				Still visible	11 45 11·3	2 30 51·0			,,
110				Disappearance	11 45 29·3	2 31 9·0			,,
111	March 20.	S.	II. Tr. E.	Ext. contact	9 48 36·9	0 34 16·6			,,
112	March 23.	S.	I. Oc. D.	Ext. contact	12 17 7·1	3 2 46·8			,,
113				Abt. bisected	12 19 59·1	3 5 38·8			,,
114				Still visible	12 21 32·1	3 7 11·8			,,

Ref. No.	Date.	Observer.	Phenomenon.	Phase of Phenomenon.	Adelaide Mean Time.	Corresponding Greenwich Mean Time.	Time by *Nautical Almanac.*	Apparent Error of *N.A.*	Power used.
					h m s	h m s	h m s	h m s	
115				Disappearance	12 21 42·1	3 7 21·8			200
116	1885, March 24.	S.	I. Tr. I.	Abt. bisected	9 38 54·8	0 24 34·5			,,
117				Int. contact	9 42 4·8	0 27 44·5			,,
118	March 24.	S.	I. Sh. I.	First seen	10 24 14·7	1 9 54·4			120
119				Int. contact	10 26 54·7	1 12 34·4			,,
120	March 27.	S.	II. Tr. I.	Ext. contact	8 10 15·9	22 55 55·6			200
121				Abt. bisected	8 12 15·9	22 57 55·6			,,
122				Int. contact	8 14 30·9	23 0 10·6			,,
123	March 27.	S.	II. Sh. I.	First seen	9 48 40·7	0 34 20·4			,,
124				Int. contact	9 51 5·7	0 36 45·4			,,
125	March 27.	S.	II. Tr. E.	Int. contact	11 1 15·5	1 46 55·2			,,
126				Abt. bisected	11 3 10·5	1 48 50·2			,,
127				Ext. contact	11 5 40·5	1 51 20·2			,,
128	April 1.	S.	I. Oc. D.	Ext. contact	8 31 35·8	23 17 15·5			,,
129				Still visible	8 35 25·8	23 21 5·5			,,
130				Disappearance	8 35 33·8	23 21 13·5			,,
131	April 1.	S.	I. Ec. R.	First seen	11 43 39·5	2 29 19·2	2 29 35	+0 16	,,
132				Quite distinct	11 43 45·5	2 29 25·2			,,
133				Full blaze	11 46 20·5	2 32 0·2			,,

Ref. No.	Date.	Observer.	Phenomenon.	Phase of Phenomenon.	Adelaide Mean Time.	Corresponding Greenwich Mean Time.	Time by *Nautical Almanac*.	Apparent Error of *N.A.*	Power used.
					h m s	h m s	h m s	h m s	
134	1885, April 2.	S.	I. Tr. E.	Int. contact	8 9 18·2	22 54 57·9			200
135				Ext. contact	8 12 43·2	22 58 22·9			,,
136	April 2.	S.	IV. Sh. I.	Int. contact	8 49 33·2	23 35 12·9			,,
137	April 8.	C.	I. Oc. D.	Ext. contact	10 19 38·0	1 5 17·7			,,
138				Abt. bisected	10 21 26·0	1 7 5·7			,,
139				Still visible	10 23 32·0	1 9 11·7			,,
140				Disappearance	10 23 42·0	1 9 21·7			,,
141	April 9.	C.	I. Tr. I.	Ext. contact	7 40 39·6	22 26 19·3			300
142				Abt. bisected	7 42 58·6	22 28 38·3			,,
143				Int. contact	7 45 13·6	22 30 53·3			,,
144	April 9.	C.	I. Sh. I.	First seen	8 42 38·0	23 28 17·7			200
145				Int. contact	8 45 29·5	23 31 9·2			,,
146	April 9.	C.	I. Tr. E.	Int. contact	9 57 33·3	0 43 13·0			300
147				Abt. bisected	9 59 23·3	0 45 3·0			,,
148				Ext. contact	10 1 37·3	0 47 17·0			,,
149	April 9.	C.	I. Sh. E.	Int. contact	10 57 33·2	1 43 12·9			200
150				Limb complete	11 0 25·2	1 46 4·9			,,
151	April 10.	C.	I. Ec. R.	First seen	8 7 12·7	22 52 52·4	22 52 57	+0 5	,,
152				Quite distinct	8 7 20·9	22 53 0·6			,,

Ref. No.	Date.	Observer.	Phenomenon.	Phase of Phenomenon.	Adelaide Mean Time.	Corresponding Greenwich Mean Time.	Time by *Nautical Almanac.*	Apparent Error of *N.A.*	Power used.
					h m s	h m s	h m s	h m s	
153				Full blaze	8 10 50·9	22 56 30·6			200
154	1885, April 10.	C.	IV. Oc. D.	Ext. contact	9 23 30·8	0 9 10·5			,,
155				Still visible	9 31 10 8	0 16 50·5			,,
156				Disappearance	9 31 26·8	0 17 6·5			,,
157	April 17.	C.	I. Oc. D.	Ext. contact	6 37 24·0	21 23 3·7			300
158				Abt. bisected	6 39 11·0	21 24 50·7			,,
159				Int. contact	6 40 50·0	21 26 29·7			,,
160	April 27.	C.	IV. Oc. R.	Ext. contact	6 36 35·7	21 22 15·4			200
161	April 28.	C.	II. Tr. I.	Ext. contact	7 4 3·1	21 49 42·8			,,
162				Abt. bisected	7 6 27·1	21 52 6·8			,,
163				Int. contact	7 8 40·1	21 54 19·8			,,
164	April 28.	C.	II. Sh. I.	Int. contact	9 32 12·8	0 17 52·5			,,
165	April 28.	C.	II. Tr. E.	Abt. bisected	9 58 32·8	0 44 12·5			,,
166				Ext. contact	10 0 25·8	0 46 5·5			,,
167	April 29.	S.	III. Oc. R.	First seen	7 1 35·8	21 47 15·5			,,
168				Ext. contact	7 3 0·8	21 48 40·5			,,
169	April 29.	S.	III. Ec. D.	Very faint	8 30 30 7	23 16 10·4			,,
170				Disappearance	8 30 52·7	23 16 32·4	23 12 41	−3 51	,,
171	April 29.	C.	III. Ec. R.	First seen	11 53 44·2	2 39 23·9	2 38 10	−1 14	120

Ref. No.	Date.	Observer.	Phenomenon.	Phase of Phenomenon.	Adelaide Mean Time.	Corresponding Greenwich Mean Time.	Time by *Nautical Almanac*.	Apparent Error of *N.A.*	Power used.
					h m s	h m s	h m s	h m s	
172				Quite distinct	11 53 57·4	2 39 37·1			120
173				Full blaze	12 1 10·4	2 46 50·1			,,
174	1885, April 30.	C.	II. Ec. R.	First seen	7 30 51·6	22 16 31·3	22 17 17	+0 46	200
175				Quite distinct	7 31 5·8	22 16 45·5			,,
176				Full blaze	7 35 7·8	22 20 47·5			,,
177	May 2.	C.	I. Tr. I.	Ext. contact	7 41 26·1	22 27 5·8			300
178				Abt. bisected	7 44 9·1	22 20 48·8			,,
179				Int. contact	7 46 9·1	22 31 48·8			,,
180	May 10.	C.	I. Oc. D.	Ext. contact	6 42 1·5	21 27 41·2			200
181				Abt. bisected	6 43 44·5	21 29 24·2			,,
182				Last seen	6 45 22·5	21 31 2·2			,,
183	May 10.	C.	I. Ec. R.	First seen	10 15 57·2	1 1 36·9	1 1 33	−0 4	,,
184				Quite distinct	10 16 6·2	1 1 45 9			,,
185				Full blaze	10 19 44·2	1 5 23·9			,,
186	May 22.	S.	IV. Tr. E.	Ext. contact	7 32 21·3	22 18 1·0			,,
187	May 25.	S.	I. Tr. I.	Ext. contact	7 52 21 9	22 38 1·6			,,
188				Abt. bisected	7 54 41·9	22 40 21·6			,,
189				Int. contact	7 58 21·9	22 44 1·6			,,
190	May 27.	S.	I. Sh. E.	Int. contact	5 50 16·9	20 35 56·6			,,

Ref. No.	Date.	Observer.	Phenomenon.	Phase of Phenomenon.	Adelaide Mean Time.	Corresponding Greenwich Mean Time.	Time by *Nautical Almanac.*	Apparent Error of *N.A.*	Power used.
					h m s	h m s	h m s	h m s	
191				Limb complete	5 53 16·9	20 38 56·6			200
192	1885, May 30.	S.	II. Tr. I.	Ext. contact	6 40 37·4	21 26 17·1			,,
193				Abt. bisected	6 42 47·4	21 28 27·1			,,
194				Int. contact	6 46 52·4	21 32 32·1			,,
195	June 1.	S.	II. Ec. R.	First seen	7 10 32·8	21 56 12·5	21 56 49	+0 37	,,
196				Quite distinct	7 10 37·8	21 56 17·5			,,
197				Full blaze	7 13 32 8	21 59 12·5			,,
198	June 9.	C.	I. Oc. D.	Ext. contact	8 53 54·5	23 39 34·2			,,
199				Abt. bisected	8 55 41·5	23 41 21·2			,,
200				Last seen	8 57 4·5	23 42 44·2			,,
201	June 10.	S.	I. Tr. I.	Ext. contact	6 15 33·5	21 1 13·2			,,
202				Abt. bisected	6 17 28·5	21 3 8·2			,,
203				Int. contact	6 20 18·5	21 5 58·2			,,
204	June 10.	S.	I. Tr. E.	Ext. contact	8 37 33·5	23 23 13·2			,,
205	June 11.	C.	I. Ec. R.	First seen	6 54 8·4	21 39 48·1	21 39 37	−0 11	,,
206				Quite distinct	6 54 12·9	21 39 52·6			,,
207				Full blaze	6 57 40·9	21 43 20·6			,,
208	June 11.	C.	III. Oc. R.	First seen	7 3 23·9	21 49 3·6			300
209				Ext. contact	7 8 20·9	21 54 0·6			,,

Ref. No.	Date.	Observer.	Phenomenon.	Phase of Phenomenon.	Adelaide Mean Time.	Corresponding Greenwich Mean Time.	Time by *Nautical Almanac*.	Apparent Error of *N.A.*	Power used.
					h m s	h m s	h m s	h m s	
210	1885, June 11.	C.	III. Ec. D.	Very faint	8 27 30·9	23 13 10·6			200
211				Last seen	8 27 42·9	23 13 22·6	23 10 18	−3 5	,,
212	June 17.	S.	I. Tr. I.	Ext. contact	8 12 48·9	22 58 28·6			120
213				Int. contact	8 18 8·9	23 3 48·6			,,
214	July 6.	C.	III. Tr. I.	Ext. contact	6 12 43·5	20 58 23·2			200
215				Abt. bisected	6 16 26·5	21 2 6·2			,,
216				Int. contact	6 22 31·5	21 8 11·2			,,
217	July 12.	C.	I. Tr. E.	Int. contact	5 25 37·8	20 11 17·5			,,
218				Abt. bisected	5 27 37·8	20 13 17·5			,,
219				Ext. contact	5 29 47·8	20 15 27·5			,,

Observers: C. = Mr. Cooke. S. = Mr. Sells.

Drawings of Jupiter and Saturn.

The Society has been presented by Mr. C. Todd with a series of 28 drawings of *Jupiter*, made at Adelaide with the 8-inch refractor between 1885, April 27, and 1886, February 9; and by Mr. K. F. Tarrant, with four drawings of *Jupiter* on 1885, February 15, March 15, 21, 29, and one of *Saturn*, made with a reflector of 10 inches aperture. These drawings have been placed in the Library.